The corrections to Schiaparelli's elements are quite small, and perhaps of little practical importance. My chief object in bringing the subject forward is to direct attention to the circumstance that, according to these elements the periastron passage occurred in the early part of the present year, in the hope that observers in the southern hemisphere may be induced to make observations of this interesting binary before the present critical state of things has passed away.

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*Observations of the Companion of Sirius, made at the Dearborn Observatory, Chicago.* By Professor G. W. Hough, Director.

(*Communicated by the Secretaries.*)

| Date. | Sid. Time. | P. | S. | Date. | Sid. Time. | P. | S. |
|---|---|---|---|---|---|---|---|
| | h | ° | ″ | | h | ° | |
| 1880·151 | | 48·7 | 9·77 | 1882·145 | 7·3 | 42·7 | 9·32 |
| ·173 | | 52·3 | 9·79 | ·148 | 7·0 | 42·7 | 9·35 |
| ·181 | | 47·8 | 10·05 | ·164 | 7·2 | 43·0 | 9·22 |
| | | | | ·195 | 7·3 | 42·8 | 9·26 |
| 1881·206 | | 45·2 | 9·47 | 1882·991 | 5·2 | 41·9 | 8·98 |
| ·260 | | 45·7 | 9·62 | 1883·066 | 6·1 | 39·3 | 8·81 |
| ·269 | | 47·3 | | ·074 | 6·7 | 40·8 | 9·23 |
| ·280 | | 44·9 | | ·115 | 5·5 | 39·3 | 9·11 |
| ·288 | | 43·3 | 9·71 | ·131 | 6·0 | 39·5 | 9·03 |
| | | | | ·134 | 6·1 | 39·8 | 8·83 |
| 1882·085 | 6·0 | 43·8 | 9·35 | ·137 | 5·6 | 39·2 | 9·17 |
| ·088 | 6·0 | 43·8 | 9·25 | ·142 | 7·5 | 39·5 | clouded |
| ·102 | 6·0 | 43·1 | 9·27 | ·159 | 6·3 | 39·7 | 9·02 |
| ·104 | 7·0 | 43·4 | 9·32 | ·175 | 6·9 | 39·6 | 8·99 |
| ·109 | 6·5 | 42·9 | 9·32 | ·195 | 7·9 | 38·0 | 9·03 |
| | | | *Results.* | | | | |
| 1880·168 | | 49·6 | 9·87 | 1882·127 | | 43·1 | 9·30 |
| 1881·260 | | 45·3 | 9·60 | 1883·120 | | 39·7 | 9·02 |

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*On Hell's alleged Falsification of his Observations of the Transit of Venus in* 1769. By Simon Newcomb.

The story of Hell's supposed tampering with his observations of the Transit of *Venus*, made at Wardhus in 1769, is so familiar to all interested in the subject that only a brief mention of its points is necessary. It is, in substance, that he delayed publishing his observations so long as to give rise to the suspicion of intending to alter them; that he showed them to no one until

after he had received the observations made at other stations; that a cloud was thus thrown over their genuineness; that the suspicions thus excited were confirmed in 1835 through the discovery and publication by Littrow of Hell's original MS. journal, which its author had neglected to destroy; and that the examination of this journal showed numerous cases of alteration and erasure of the original observed figures, including the seconds of first interior contact, which had been completely erased and replaced by new numbers inserted with different ink at some subsequent time. And the reason for all this was supposed to be that Hell desired to publish, not his true observations, but results which should be in the best possible accordance with the observations of others.

More precise statements on some points are these:—The Transit occurred 1769, June 3; Hell's party sailed from Wardhus June 27, but meeting with delays from adverse weather, and stopping to make observations, they did not reach Drontheim until August 30. After some stay here and in Christiania, Copenhagen was reached on September 17. The observations were communicated to the Danish Academy of Sciences in November or December; the printing commenced December 13, and on January 13, 1770, Hell received twenty printed copies.* For the statement that Hell was loudly called upon for his observations before he would consent to their publication, I do not know the original authority.

I have taken advantage of a visit to the Imperial Observatory of Vienna to make, with the consent and support of its Director, Professor E. Weiss, an examination of Hell's manuscript. The result is so different from that generally accepted that it seems proper to prepare a statement on the spot, with the documents before me and the circumstances in mind, instead of waiting to make a more elaborate discussion in another place.

The document with which we are principally concerned is a thin MS. volume in folio, containing twenty-seven finely written pages, and nearly as many blank ones, bearing the heading "Observationes Astronomicæ et Cætera in Itinere litterario Viennâ Wardöehusium factæ. 1768. A. M. Hell."

This volume is assumed to be in Hell's own writing, and to be his original journal of his observations. Littrow apparently treats of it as the actual first record of Hell's observations. This seems very improbable. The pages are too large to be held in the hand at the telescope, and the figures of the observations fit too well into the record to suppose that they can be the figures first written. Indeed, it is hardly conceivable that one should have written an account of the circumstances up to the moment of first contact in so continuous a way that the figures of the observation could have been put in at the moment of observation. These figures must therefore have been copied from rough notes

* These dates are from Littrow's work, *P. Hell's Reise nach Wardoe*, Journal of Sajnovics, pp. 143–158.

of some kind made at the telescope, and put in when, after the observation, Hell had an opportunity to write up the journal.

This being admitted, the question might arise whether the journal was certainly written at Wardhus at all, and could not have been written up subsequently from rough notes. Circumstances too numerous to be detailed show that the writing was done at the station, probably at the close of each day's work or each set of observations.

In connection with this journal we have to consider Littrow's book: *P. Hell's Reise nach Wardoe bei Lapland und seine Beobachtungen des Venus-Durchganges im Jahre* 1769, *von Carl Ludwig Littrow.* (Wien, 1835.) This book contains extracts from the MS. journal above mentioned, accompanied by a copious commentary descriptive of the writing, and pointing out the alterations in the record.

Hell's own publication, of which the first edition appeared at Copenhagen in 1770, should also be compared.

A comparison of these writings in a cursory way brought out one circumstance which has always been overlooked. What Hell sent to press in December 1769 was not a transcript of this journal, but a more copious account, containing eighty-one printed pages, with only an occasional identity of language. But, with a single unimportant exception, the numbers are all printed without change from the original MS. journal, whether corrected or uncorrected in that journal. Now, this fact can be reconciled with the supposition that the printed numbers were the result of calculation from the observations of others in only a single way: the journal must have been corrected from the printed book; for it is contrary to human nature to suppose that if Hell had once set out to publish numbers derived from extraneous sources he could have failed to find occasion to correct them from time to time, as new data arrived and new computations were made, and the final numbers could have been reached only when the book was printed.

Now, it is very clear to me, and the evidence will be given presently, that nearly all the alterations were made at the station—two, at least, before the ink got dry. I therefore conclude from this general survey that *whatever the sources from which the corrections were derived, the numbers as printed by Hell were all but one or two obtained at Wardhus.*

I now go into the corrections more in detail, and begin with two bad-looking cases, having, however, no direct reference to the Transit.

I. The times of the corresponding altitudes observed on June 4 are so corrected and altered as to bring about a better agreement among the individual results. Measured by our standard, this was dishonest, but, as I have elsewhere shown, more than one astronomer of good repute in the last century considered it quite right and proper. Considering the matter in a practical and not in a moral light, I submit without discussion

the proposition that, from the fact that an observer is capable of altering the individual observations of a series made by himself to make them consistent, it does not follow that he would alter his own observations to bring them into agreement with the results of a long and laborious calculation from the not more certain observations of others.

II. Having observed the last of the above-mentioned altitudes at $10^h\ 8^m\ 18^s$ (a record which he leaves unaltered), he added, originally:—

"N.B. ante hanc positionem minuto 8 10″ mane observatum est initium eclipsis ⊙, quod mihi jam 20 secundis circiter citius factum fuisse videtur." After his return to Copenhagen he altered the 10″ to 27″, and the 20 to 6, which makes the observation *post* instead of "ante." The change of wording *ante* to *post* is made in the printed book, but not in the journal.

Now, since Hell made no attempt at a serious observation of the beginning of the eclipse, but was (it is evident) content with incidentally remarking it as he was taking time observations with his quadrant; since, also, it came within $10^s$ of an observation of altitude, so that he could not independently have noted it, he might well have been uncertain as to whether it was $8^s$ or $9^s$ before or $8^s$ or $9^s$ after the altitude time, and have changed his opinion after writing the note. Indeed, in the printed book he speaks of the numbers as a mere guess: "accipiebam correspondentes." Again, looking at the matter from a practical standpoint, this very alteration may supply us with a ground for believing that Hell's corrections were not made with the object of deceiving, for he could have had no such object in this alteration. He lays no stress on the observation, expressly says that such a contact cannot be accurately observed, and does not use it to determine his longitude.* Only the observed end of the eclipse he considered available for this purpose, and *he gives this without alteration.*

* Since writing this sentence, I find its last statement curiously at fault. It is true that Hell repeatedly expresses the view here attributed to him, remarking: "Et cum verus in Initio Eclipsium Solarium contactus limbi Lunæ cum limbo Solis sit observatu impossibilis . . . solo utar fine Eclipseos variis in locis observato"; and he carries through his discussion on this principle. But when he comes to the Wardhus observations, he suddenly brings in an observed time of beginning, $21^h\ 22^m\ 47^s$, and actually pretends to give it the same weight as the observation of end. Between this time and the altered record in the journal there is a break of continuity arising from the fact that neither in MS. nor print does he give the clock error he applied. But the clock error computed from his data is $45^m\ 32^s$, which would give $10^h\ 8^m\ 19^s$ as the adopted clock time, which corresponds to nothing, but is nearest to the altitude itself. It might be supposed that the estimated 5 or 6 seconds was subtracted before applying the clock error, but in one place he expressly says this is still to be done. The substance of the case is this:—The observed end he gives accurately and faithfully, and uses it correctly. The beginning he frankly acknowledges to have been nothing but a series of guesses, yet, having adjusted the guesses to give a longitude only $2^s$ different from that of the end, he treats it as a sound result.

We now go back to the observations of contact, beginning with first contact. In his journal he first wrote: "Venus hora 9. m. 1?′ 35″ observata est, jam parte aliqua sui diametri ingressa, ita ut existimem primum contactum 20″ circiter ante factum." The figure in the place (?) is illegible in consequence of having been blotted out with the finger before the ink got dry. There is a vague suggestion of a figure 4 in the blot, but superposed on this a much better defined loop, apparently the top of a figure 6, as Hell used to write it. But the bottom of the 6 is totally wanting, though it ought plainly to show. Then over the blotted figure is written a heavy figure 5, and over the 35 is written an equally heavy 17, thus making the time $9^h\ 15^m\ 17^s$. An attempt was also made to blot out the 2 in the 20 by a stroke of the finger before the ink got dry, but enough of the figure was left for identification. Over it is written 3, making the estimate $30^s$ instead of $20^s$.

It is quite clear to me that the alterations were made with the same ink as the original, apart from the testimony afforded by the blots; for, although the corrections look strikingly darker than the rest of the writing, we find that wherever an unusually thick layer of ink happened to run from the pen, it looks almost as dark.

On this alteration Littrow remarks that it was probably made "nach der erst später, aus dem Austritte bekannt gewordenen Verweilung des Venusdurchmessers am Sonnenrande." I cannot explain this suspicion. The "Verweilung aus dem Austritte" was $18^m\ 9^s$, which, subtracted from the time of internal contact at ingress, gives $9^h\ 14^m\ 32^s$ for first external contact. This is $45^s$ earlier than the corrected time, and $15^s$ earlier after the estimated $30^s$ is subtracted.

For more light we refer to the printed account, which is very explicit. The three men were at the telescopes, an assistant at the clock, carefully watching the face. Whoever saw a small notch in the expected place "illico exclamaret," while "famulus" was to note hour, minute and second by the clock. Borgrewing called first, and immediately afterwards Sajnovics; then Hell, looking into his telescope, saw it. "Erat autem momentum, quo D. Borgrewing & P. Sajnovics exclamarunt, famulo indicante in horologio Viennensi $9^h\ 15'\ 17''$."

Returning to the MS., it looks to me as if a 6 was first written; before the ink was fully dry a 4 was written over it, but immediately erased with the finger and changed to a 5. However this may be, I see no more plausible explanation of the change than some accidental error in first writing down the time in the journal after the observation was over. It is not stated whether "famulus" communicated his time by speech or writing, and I cannot but suspect that the entire minutes were partly guess-work. But the coincidence of the number of seconds (35) with that given in the next following record, that of internal contact, is at least suggestive. Of course Hell had his rough

record of the contact before him when he wrote. Can it be supposed that, in the hurry of writing he took the seconds out of the wrong line, but not the minutes? If so, it would not only explain the error, but would afford positive proof that the disputed record of internal contact was before his eyes at Wardhus when he wrote.

I can only regard one conclusion as certain: that the corrections were made at the time of writing, and without the slightest intention of giving anything but the actually observed moment when *Venus* was first seen.

We now come to the much-disputed observations of internal contact, which appear in the journal in the following form:—

| | h | m | s | |
|---|---|---|---|---|
| "Videtur contactus fieri ... ... ... | 9 | 32 | 35 | |
| Contactus certus visus ... ... ... | | 32 | 41 | |
| fulmen ... ... ... | | 32 | 48 | |
| Pater Sajnovics suo tubo contactus dubius | 9 | 32 | 30 | 30 |
| certissimus ut ajebat ... | | 32 | 45 | 45" |

At first sight the figures of seconds, 35 and 41, in Hell's observations seem to be corrected figures. Littrow remarks upon them that the paper here and below bears marks of having been scraped, and that the original figures of seconds had been carefully erased; in consequence the ink had spread in the paper. But one sees at a glance that the latter statement is erroneous. The figures have not that diffused outline which arises from the absorption of ink in the tissue of the paper, but are, on the contrary, well defined with perfectly sharp edges and no loss or change of tint near the border. It is, however, true that when one looks carefully he receives the impression that the paper has been scraped all the way down the column of seconds, and especially where the observations of Sajnovics are written. But we may also note that this is near where the paper has been folded, and that there are diversities of the same sort here and there in other parts of the MS., which evidently are the mere effect of age and accident. Moreover, it is only Hell's figures of seconds which show the slightest trace of being written on a scraped surface.

Happily the question of erasure admitted of an easy and decisive settlement. The paper is of a kind which I believe is now called "wove," and of which the original ribbed surface has not been smoothed off by glazing. It was therefore examined in a dark room by direct sunlight shining through an opening, and the paper was held so that the rays should strike it at a very small angle. The ribbed texture of the surface was then brought out in bold relief of light and shadow, and it was clearly seen that the ribs extended continuously through Hell's disputed figures without the slightest break or loss of strength, except one little depression between the lines where it looked as if a

dot had been dug out with the point of a knife. Over the observations of Sajnovics the ribs are not so distinct, but they were most obliterated in the column of minutes, about which there is no dispute. Moreover, these variations are seen everywhere on the paper.

To put the matter still further beyond doubt, I asked Director Weiss's permission to write on one of the blank pages and try whether it were possible to erase the figures without injuring the texture of the surface. It was not found possible when the test of oblique sunlight was applied.

The question of erasure thus disposed of, our attention is once more directed to Hell's heavy figures, 35 and 41. We first remark that Hell's style of figure is so distinctive that in all other cases where he has written one figure over a different one, no matter how heavily, parts of the original figure can be seen protruding, and, when not blotted out with the finger, can be identified. But in this case, there is but a single trace of a figure under those written—namely, when examined with a magnifying glass, we see under one edge of the 4 what seems to be part of an original 4.

The evidence is therefore conclusive that no different figures from those now visible were ever written here. If, then, they are in any way the result of calculation from other observations, the place must have been left blank until Hell got back to Copenhagen, and made the necessary calculations. This hypothesis seems to me too fanciful for serious discussion, especially as we have an obvious explanation of the suspicious character of the figures. The ink did not always flow well from the pen, and figures as well as letters are frequently retouched in this part of the MS. Noticing that the figures as he first wrote them were not so complete and distinct as he desired them, he immediately wrote them over again in the spirit and with the hand of a man who was determined that no imperfections of pen and ink should be allowed to render so important a record doubtful.

This explanation is possibly in contradiction with a statement of Littrow that the figures 35 and 41 are made in much darker ink than that of the original. I say "possibly," because I am unable to infer from Littrow's statement exactly what individual figures and words he meant to say were written with this "viel schwarzerer Tinte." But that he was entirely at fault in saying that the corrections and alterations here described were made in different ink, my eyes do not permit me to doubt. The ink, of course, looks darker where the figures are heavily re-written, but this is only because the layer of ink is thicker. The tint is obviously the same.

We now reach a part of the record which looks more suspicious. The line "fulmen 9 32 48" is not only an interlineation, but is written in decidedly different ink from all the original MS.—an ink which has not faded so much as the other, and so has almost a blue tinge by contrast. That Littrow, in

arraying his proofs of Hell's forgery, should have failed to dwell upon the obvious difference between this ink and that with which the alterations were made leads me to suspect a defect in his sense of colour.* The original journal, up to the time that Hell left Wardhus, being all written in one kind of ink, we conclude that the insertion was made after he reached Copenhagen. To judge of its meaning and origin, we must refer to Hell's printed book, where the time is given as that of the formation of the thread of light. Moreover, this time, and that of certain contact, have reference to foot-notes in which it is remarked that some observers take the one, and some the other, for the true contact. I therefore conclude that he did not add this phase until he had seen the observations of others. We therefore meet the question, Was it a manufactured time, the material for which was furnished by other observations, or was it fixed solely from what he saw at Wardhus? Two circumstances seem to me to render the first hypothesis very improbable.

The first is, that the time $32^m\ 48^s$ is uncorrected in the MS. and identical with that in the printed book. A time concluded from other sources would have been subject to so many alterations as new data came in, that we could not expect this coincidence.

The other is, the shortness of the interval, $7^s$, between the two phases. The observations in Western Europe, which Hell must have first seen, were made with a very low altitude of the Sun, and so gave differences ranging from $10^s$ or $20^s$ up to $60^s$. A difference manufactured from these data could not have been so small as $7^s$.

Two hypotheses are before us as to how the insertion was determined. We may suppose that Hell, when he found he had omitted what other observers considered an important phase, tried to remember how long after the recorded contact he first saw the Sun's limb continuous, and wrote the result in his journal; or we may suppose that he made a memorandum at the time of the observation, but omitted to copy it in the journal, either through inadvertence, or because he deemed it too late for contact. When he found the phase important, he merely copied the omitted record in his journal.

The use of the queer word "fulmen," which appears only in the MS., seems to me to give colour to the last hypothesis. We can hardly conceive of one using it deliberately, after six months, to express the formation of the thread of light; whereas at the

* At the time of writing this sentence (which he has been careful not to alter) the writer had no idea that any defect was known to exist in Littrow's sense of colour. But on reviewing the comparison of his description with the MS., the case seemed even stronger than the writer had put it. He therefore made inquiries of an authority likely to be well-informed, whether Littrow had ever been suspected of colour-blindness, and was informed in reply that he really was colour-blind to red, and could see no difference between the colour of *Antares* or *Aldebaran* and that of other stars. After receiving this information, no further note was made of Littrow's views of the different inks used.

moment of observation, in the excitement and hurry, it would be a very natural single word to designate the rapid increase of the effulgence of solar light around the following limb of *Venus*, which follows true contact at ingress.*

In printing, the 41$^s$ of the MS. has, intentionally or through inadvertence, been changed to 42$^s$. I have no explanation of this to offer. Nor can I explain the double column of seconds in the record of Sajnovics' times.

We come now to egress. The times of Hell's notes of the "gutta nigra" are each increased by 2$^s$, but obviously this correction was made at the time of writing. More serious is a correction of Sajnovics' time. As originally written, they read—

"Pater Sajnovics contactus dubius ... 15 26 20
certus ... 26"

So far as can be inferred from the MS., the first second might have been 26 as well as 20, only then the two times would have been the same, which is improbable. The last line, "certus . . . 26," and the word "dubius," were then struck out on the spot, and the word *certus* substituted for *dubius*. Whether this was merely a suppression of the "contactus dubius," or included also a change of the "contactus certus" from 26 to 20, we cannot say, the MS. being torn where the top of the 6 belongs; but the latter seems more probable, as otherwise there would have been no object in the change. But this is not all. The 20 or 26 is again changed to 18, and so printed. Moreover, this last change appears to be made with a different ink, and, so far as can be judged from so small a surface, the same ink with which the line "fulmen" was written. The explanation is too obvious to need more than a statement. An observation of contact is not like one of a star transit, in which the observer must observe a moment which he cannot alter. It can be only an estimated mean moment for a gradually changing phenomenon extending through a number of seconds. This estimate is liable to change in the mind of the observer as he subsequently thinks over the progress of the phenomenon as he saw it. I should be inclined to accept a change of opinion thus reached, if it were not suggested by a comparison with the results of others. Now, Sajnovics was the constant companion of Hell, both on the journey and while the observations were going through the press. They, no doubt, discussed their times, and in consequence of such discussion Sajnovics concluded that his times were late.

In the exterior contacts the only correction is a change of Hell's time of "contactus dubius" from 20$^s$ to 22$^s$, while "certus" remains 26$^s$. I attach no importance to this change, which was evidently made at the time of writing.

* I regard it as a strong confirmation of this view that Mr. Stone, without apparently having made any comparison with Hell's printed observations, reached this same conclusion as to the probable use of the word "fulmen." See *Monthly Notices* R. A. S., vol. xxix. p. 242.

To make this discussion more complete, we may now consider certain collateral circumstances which have been supposed to cast suspicion upon Hell's intentions. First and most oft repeated among these is a supposed delay in making known his observations. The actual facts have already been mentioned. It may be added that, on his return to Copenhagen, Hell proceeded to prepare a complete account of his instruments, observations, and results, which included an investigation of his quadrant and clocks, a discussion of his latitude, longitude, and time, and a full statement of his observations. The whole paper, extending to 80 closely-printed pages, was written, printed and ready for distribution four months after his return to Copenhagen. Not only do I see no suspicious delay here, but it seems to me difficult to suppose that he could have had time to make so complete a reduction of the observations of others as to be able to compare them with his own.

It is true that he did not publish his observed times of contact in advance, as many others did. The reasons he is said to have assigned for this course—such as the amount of computation necessary, and the command of the King not to publish in advance of the official paper—are declared by Encke unworthy of the slightest consideration. They seem to me quite sound reasons. When the party got back to Copenhagen they had an audience of the King, and asked his consent to dedicate their observations to him. That observations made under his auspices, dedicated to him, and published by his Academy of Sciences, should first appear in official form, seems to me a very proper feeling, especially when we consider that, owing to the position of the station being unknown, publication in advance could have served no useful purpose.

Littrow also notes as suspicious circumstances certain expressions of devout sentiment which are scattered here and there in Hell's journal, and which he seems to regard as efforts to compound with his conscience for the sense of guilt with which it was oppressing him. This is possible. But it is equally possible that these expressions were the result of a generally devout state of mind not at all incompatible with moral integrity. Extraneous circumstances will decide the question. Each volume of Hell's *Ephemerides Vindobonienses*, so far as I have noticed, concludes with a similar sentiment. A curious incident mentioned by Sajnovics may be added. The extraordinary continuance of adverse weather which the ship encountered on her return voyage led Hell to investigate the morality of her navigators. Finding that they had on board certain contraband fish, he saw in this circumstance an explanation of the weather, and tried to get this part of the cargo disposed of. Failing in his effort, he left the ship in port and took another, after which there was an immediate cessation of the contrary winds.

In the preceding discussion I have made but slight allusion to the absence of many circumstances which we might expect to

accompany manufactured observations. I have, however, endeavoured to present all the positive evidence within reach so fully as to enable everyone to draw his own independent conclusions. My own conclusions are:—

First. The belief that there was any suspicious delay in the publication of Hell's observations, or anything in his course to give reasonable ground for a suspicion that he intended to tamper with his observations is a pure myth.

Secondly. Excepting the time of formation of the thread of light at ingress, excepting also a discrepancy of one second in the time of internal contact, and a change of two seconds in one of Sajnovics' times, it is proved, not only negatively and presumptively, but by positive evidence and beyond serious doubt, that all the essential numbers of observation given by Hell, whether relating to the transit, time, or longitude, are printed as concluded upon and written in his journal at Wardhus, before there was any possibility of communication with other observers.

Thirdly. The addition of the time of the formation of the thread of light was suggested by the accounts of other observers, but the time itself is Hell's own, obtained possibly from estimation and memory, but more probably from a memorandum made at the time of observation which he neglected to insert in his journal.

Fourthly. The alterations in Sajnovics' time of second internal contact were probably made because Sajnovics himself afterward concluded that his recorded time was too late; but it may be assumed that in reaching this conclusion he was influenced by Hell's observations.

A few words may be added respecting the writer's own proceedings in investigating this subject. In commencing the examination of Hell's journal he had no hope of doing more than decide whether it was or was not safe to use Hell's numbers as actual results of observations, and no thought of doubting the commonly received view of the case. A few notes respecting the different kinds of ink and writing were made as memoranda. Afterwards these notes were compared with Littrow's description of the MS., and the writer was perplexed to find himself differing entirely from the conclusions of Littrow. Not till the paper was nearly written did he make the inquiries which elicited the fact that Littrow was colour-blind. In justice to the latter a further explanation of the source of his probably incorrect judgment should be considered. Before he found the MS., suspicion had rested upon Hell's truthfulness. When he looked into the MS., and saw such extensive alterations in an ink seemingly different from that of the journal, the indictment seemed so clearly proved that his only duty was to make the facts which proved it known to the world. He thus unconsciously assumed the tone of a public prosecutor, and saw all the circumstances from an accuser's point of view.